INTRODUCTION

Presentation by: **Beau Churchill**

Datasets: **Police Fatalities 1760–2023, U.S. Average Temeratures (Annual)**

Date: **8/10/25**

Research Questions:

- What are the leading causes of officer-related fatalities?
- What time of year has the highest concentration of officer-related deaths?
- What day of the week has the highest concentration of officer-related deaths?
- Does average yearly temperature correlate with the number of officer-related deaths?

DATA CLEANING & PREPARATION

- No vital NAs in either dataset (surprisingly).
- In the Police dataset, there were 23,448 observations and 12 original variables (I added 3 to parse data for analysis).
- The Average Weather dataset had 123 observations and 2 variables.
- Had to align each dataset in terms of years. Police death records date back to the 1700s, while accurate weather records only started in the late 1800s. Aligned data in both datasets to start from 1900.
- The End_Of_Watch (death date) variable needed to be reformatted to a “date” data type, rather than a “text” data type.
- Data was cleaned, and variables were created in Excel before R analysis.

	A	B
1	Year	Temperature
2	1900	53.9
3	1901	53.5
4	1902	52.1
5	19	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Rank	Name	Age	End_Of_Watch	Month	Year	Day_Of_W	Cause	Departme	State	Tour	Badge	Weapon	Offender
2	Policeman	Charles O. Conaway	32	11/10/1900	November	1900	Saturday	Struck by	Philadelpl	Pennsylva	3 years, 6	634		
3	Desk Serg	Timothy S. O'Connell		5/3/1900	May	1900	Thursday	Gunfire	Chicago P	Illinois		266	Gun; Unkr	Acquitted
4	Police Off	Frederick L. Richards	44	9/8/1900	September	1900	Saturday	Weather/N	Galveston	Texas	10 years			

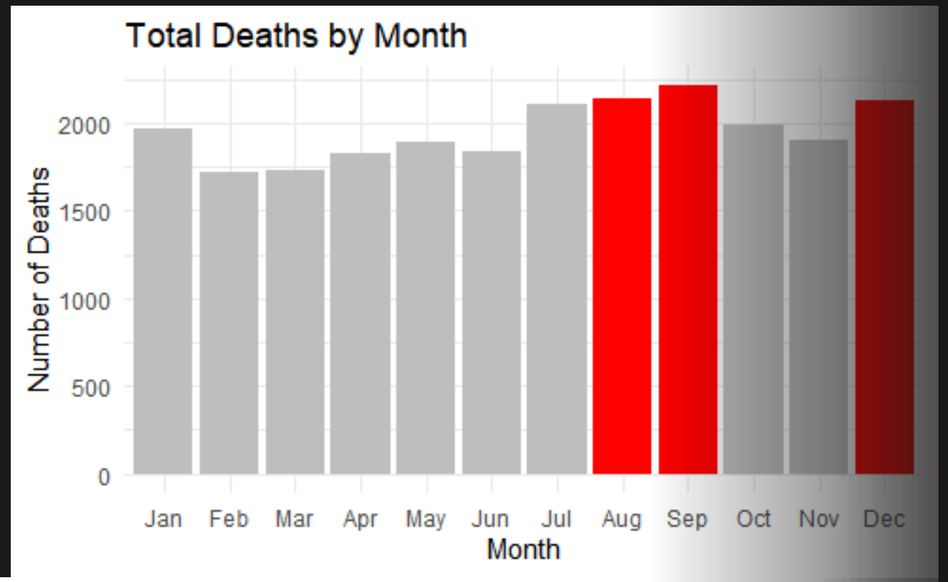
EXPLORATORY DATA ANALYSIS

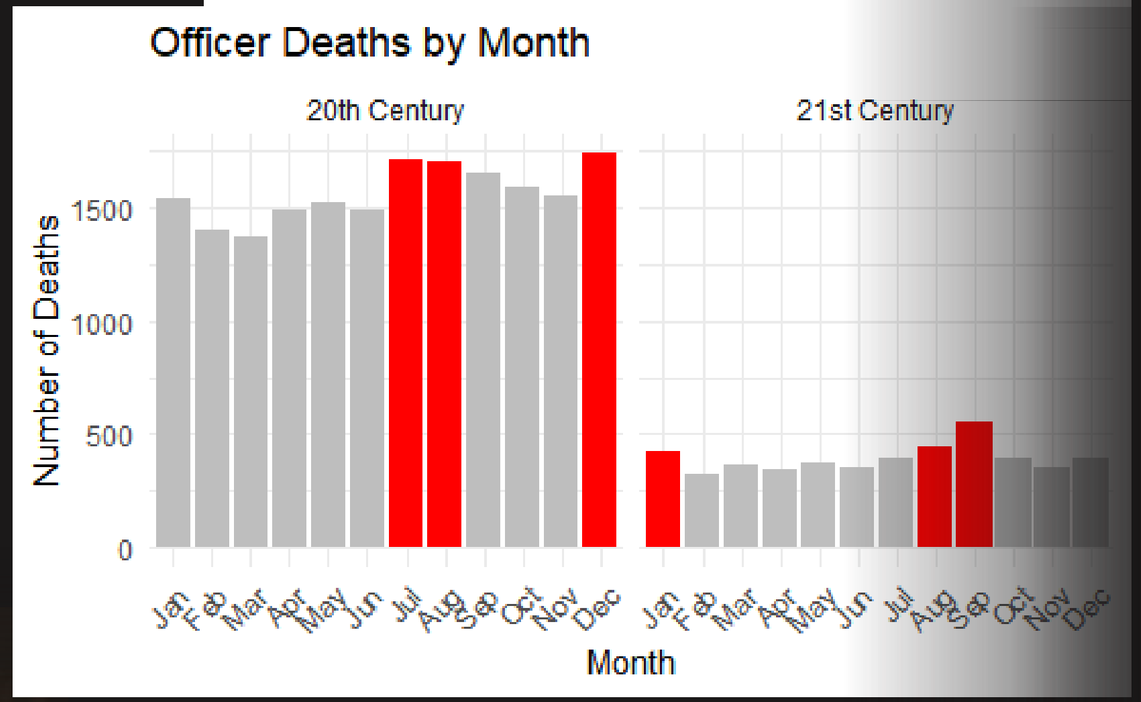
Hypothesis:

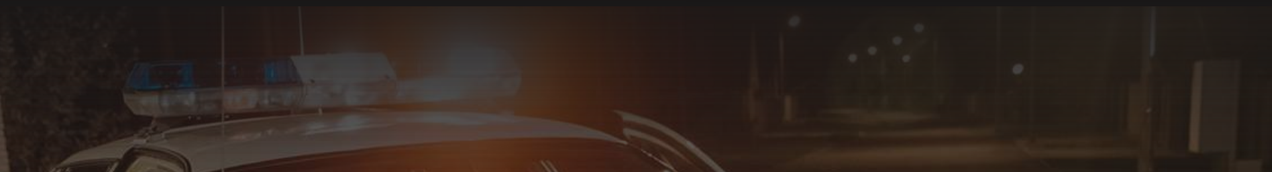
- Null Hypothesis (H_0): There is no significant relationship between average yearly temperature and the number of officer fatalities.
- Alternative Hypothesis (H_1): Higher average temperatures are associated with an increase in officer fatalities.

EDA:

- Examined trends within the police_deaths dataset.
- Identified months with the highest fatality counts.
- Noted that peak months align with seasonal temperature extremes — primarily summer (highest heat) and winter (coldest months).





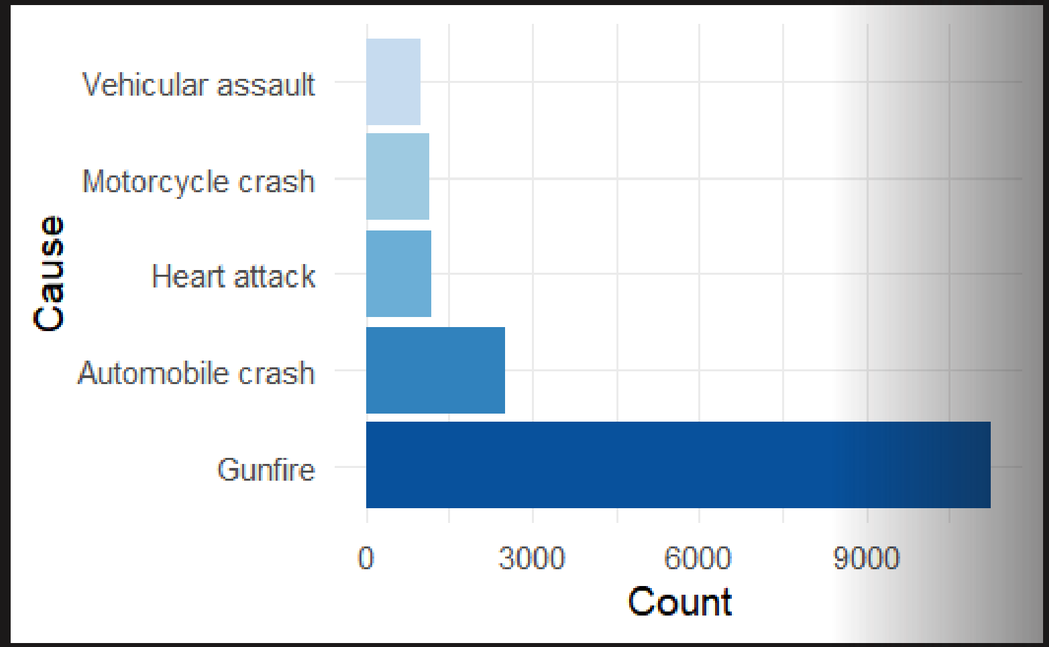


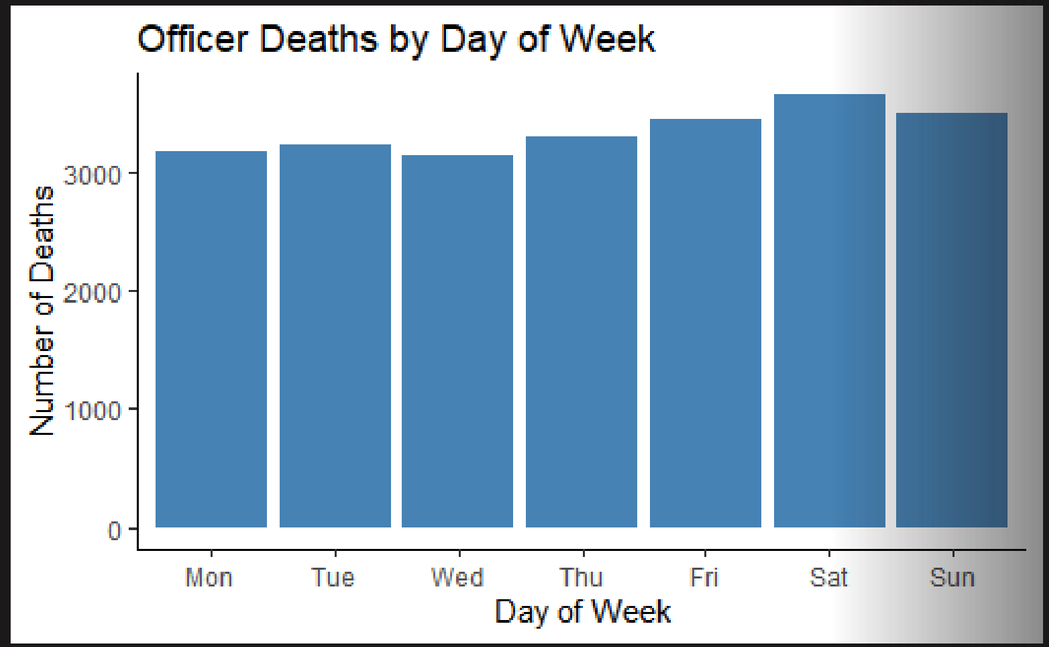
EXPLORATORY DATA ANALYSIS CONT.

Additional Explorations (Curiosity-Driven)

- Day of the Week: Analyzed fatalities by day to see if certain days had higher occurrences.
- Cause of Death: Identified and ranked the top 5 causes of officer fatalities.
- Compared these findings across all available years to spot consistent patterns.

ShotSpotter is an acoustic gunshot detection system that uses a network of sensors to identify, locate, and alert police to possible gunfire in real time.
The MPD began using it in 2006, expanding and upgrading the system over time to improve accuracy and reduce false alerts from non-gunshot noises like fireworks





KEY FINDINS AND RESULTS

TOP THREE MONTHS

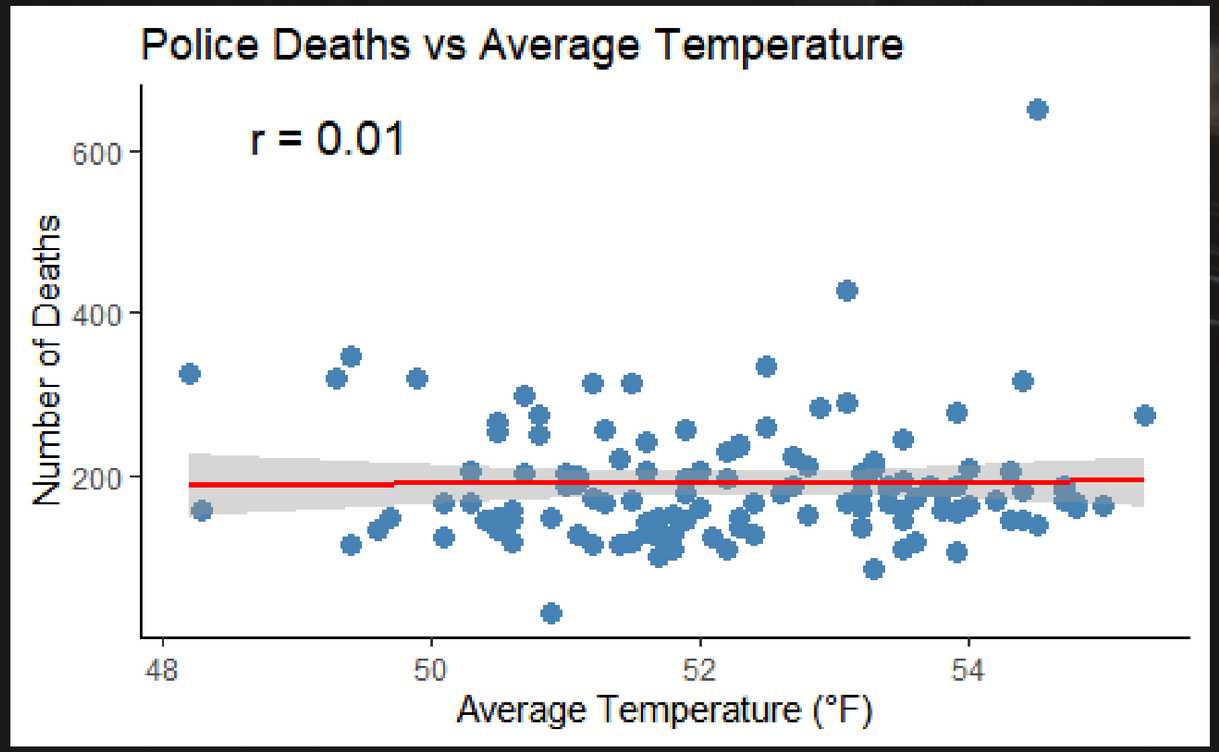
Across centuries, certain months consistently ranked highest in officer fatalities, with most deaths occurring in summer months.

DAY OF WEEK PATTERNS

Fatalities occurred on all days, with some variation in frequency across weekdays, with most deaths occurring on Saturdays.

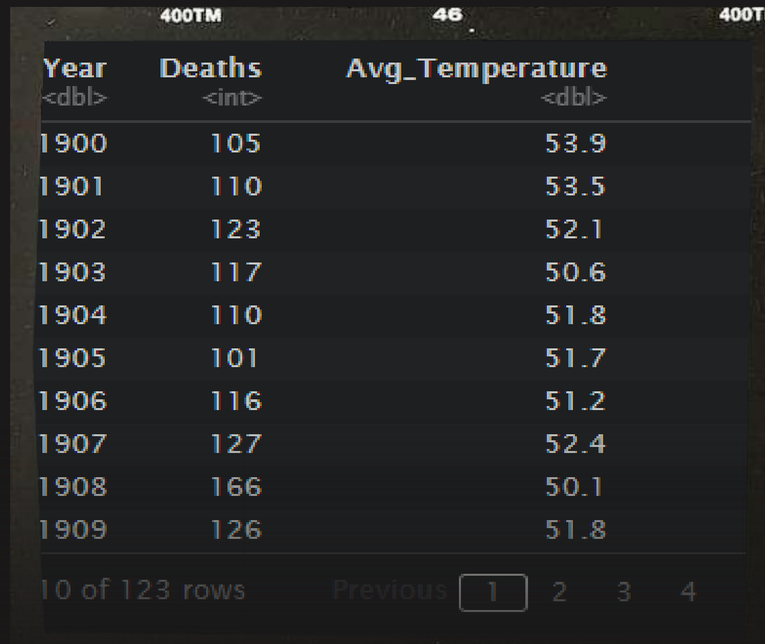
LEADING CAUSES

Top five causes of officer deaths identified, with firearm-related incidents dominating.



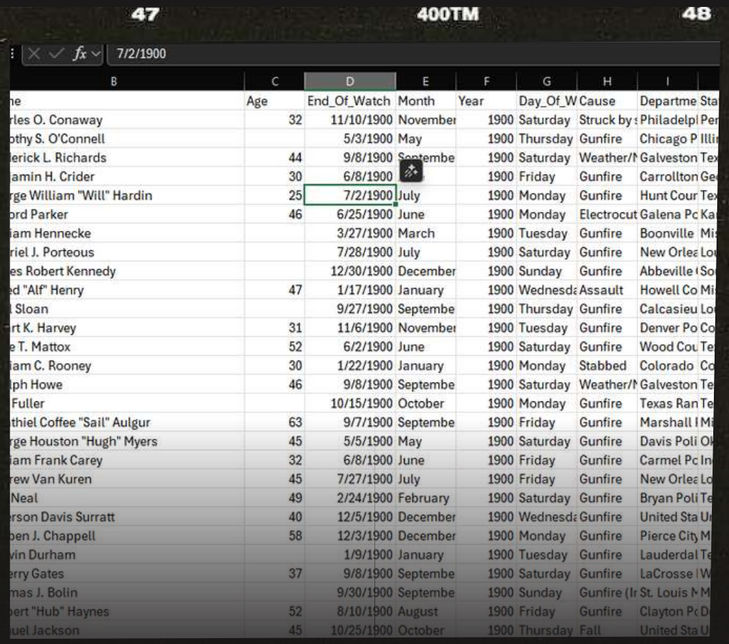
CORRELATION ANALYSIS

- r ≈ 0.01 - No measurable linear relationship between average yearly temperature and officer fatalities.
- **Conclusion:** Fails to reject the null hypothesis — temperature alone does not appear to significantly impact officer deaths, at least by yearly average temperature.



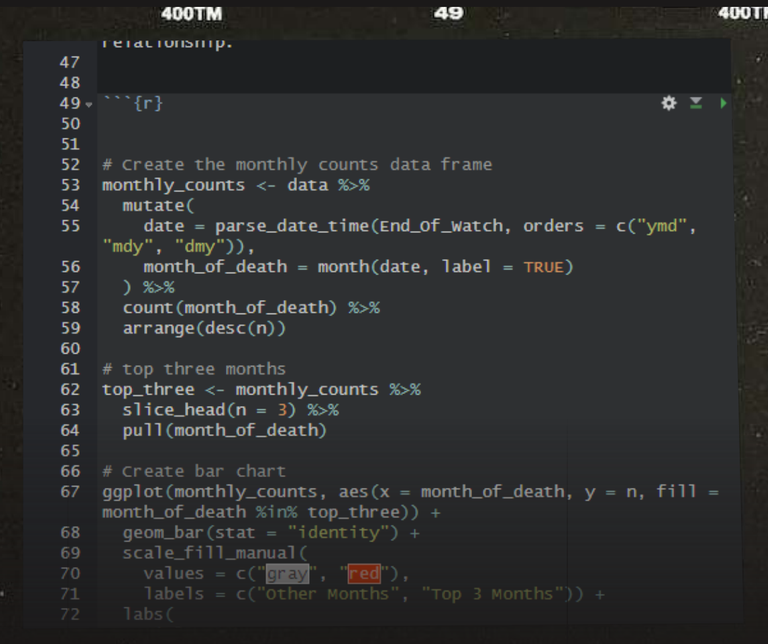
Year <dbl>	Deaths <int>	Avg_Temperature <dbl>
1900	105	53.9
1901	110	53.5
1902	123	52.1
1903	117	50.6
1904	110	51.8
1905	101	51.7
1906	116	51.2
1907	127	52.4
1908	166	50.1
1909	126	51.8

10 of 123 rows Previous 1 2 3 4



7/2/1900

B	C	D	E	F	G	H	I
ne	Age	End_Of_Watch	Month	Year	Day_Of_W	Cause	Departme Sta
rles O. Conaway	32	11/10/1900	November	1900	Saturday	Struck by s	Philadelpl Per
othy S. O'Connell		5/3/1900	May	1900	Thursday	Gunfire	Chicago P Illi
erick L. Richards	44	9/8/1900	Septembe	1900	Saturday	Weather/N	Galveston Tex
amin H. Crider	30	6/8/1900		1900	Friday	Gunfire	Carrollton Ge
rge William "Will" Hardin	25	7/2/1900	July	1900	Monday	Gunfire	Hunt Cour Tex
ord Parker	46	6/25/1900	June	1900	Monday	Electrocut	Galena Pc Ka
iam Hennecke		3/27/1900	March	1900	Tuesday	Gunfire	Boonville Mi
riel J. Porteous		7/28/1900	July	1900	Saturday	Gunfire	New Orlea Lo
es Robert Kennedy		12/30/1900	December	1900	Sunday	Gunfire	Abbeville (So
d "Alf" Henry	47	1/17/1900	January	1900	Wednesda	Assault	Howell Co Mi
Sloan		9/27/1900	Septembe	1900	Thursday	Gunfire	Calcasieu Lo
rt K. Harvey	31	11/6/1900	November	1900	Tuesday	Gunfire	Denver Po Co
e T. Mattox	52	6/2/1900	June	1900	Saturday	Gunfire	Wood Cou Te
iam C. Rooney	30	1/22/1900	January	1900	Monday	Stabbed	Colorado Co
ph Howe	46	9/8/1900	Septembe	1900	Saturday	Weather/N	Galveston Te
Fuller		10/15/1900	October	1900	Monday	Gunfire	Texas Ran Te
thiel Coffee "Sail" Aulgur	63	9/7/1900	Septembe	1900	Friday	Gunfire	Marshall I Mi
rge Houston "Hugh" Myers	45	5/5/1900	May	1900	Saturday	Gunfire	Davis Poli Ok
iam Frank Carey	32	6/8/1900	June	1900	Friday	Gunfire	Carmel Pc In
rew Van Kuren	45	7/27/1900	July	1900	Friday	Gunfire	New Orlea Lo
Neal	49	2/24/1900	February	1900	Saturday	Gunfire	Bryan Poli Te
rson Davis Surratt	40	12/5/1900	December	1900	Wednesda	Gunfire	United Sta Us
oen J. Chappell	58	12/3/1900	December	1900	Monday	Gunfire	Pierce City M
vin Durham		1/9/1900	January	1900	Tuesday	Gunfire	Lauderdal Te
rry Gates	37	9/8/1900	Septembe	1900	Saturday	Gunfire	LaCrosse W
mas J. Bolin		9/30/1900	Septembe	1900	Sunday	Gunfire (In	St. Louis M
ert "Hub" Haynes	52	8/10/1900	August	1900	Friday	Gunfire	Clayton Pc D
uel Jackson	45	10/25/1900	October	1900	Thursday	Fall	United Sta U



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relationship.

```{r}

# Create the monthly counts data frame
monthly_counts <- data %>%
  mutate(
    date = parse_date_time(End_Of_Watch, orders = c("ymd",
"mdy", "dmy")),
    month_of_death = month(date, label = TRUE)
  ) %>%
  count(month_of_death) %>%
  arrange(desc(n))

# top three months
top_three <- monthly_counts %>%
  slice_head(n = 3) %>%
  pull(month_of_death)

# Create bar chart
ggplot(monthly_counts, aes(x = month_of_death, y = n, fill =
month_of_death %in% top_three)) +
  geom_bar(stat = "identity") +
  scale_fill_manual(
    values = c("gray", "red"),
    labels = c("Other Months", "Top 3 Months")) +
  labs(
```

OBSTACLES & CHALLENGES

- **Data Availability:** Could not find a reliable dataset with monthly average temperature to pair with fatality data for finer-grained analysis.
- **Data Parsing & Cleaning:** Learned to parse dates, extract variables (year, month), and prepare datasets for analysis.
- **Advanced R Coding Skills:** Needed to quickly learn new functions and libraries; relied on Codecademy, W3Schools, Stack Overflow for solutions - and a little Gen AI, not gonna lie ;)
- **Time Alignment Issues:** Had to filter and align police fatality data (1700s onward) with temperature data (starting in 1900).
- **Working with Large Datasets:** Navigating datasets with many variables and potential research questions made it challenging to focus on the most relevant ones. All your questions get answered with more questions!
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FUTURE STEPS

- **Obtain Finer-Grained Weather Data:** Use monthly or daily temperature records to analyze seasonal or short-term effects on fatalities.
- **Include Extreme Weather Events:** Examine the impact of heatwaves, storms, or other environmental hazards on officer deaths.
- **Expand Environmental Variables:** Consider precipitation, humidity, or location-specific climate patterns.
- **Explore Additional Risk Factors:** Incorporate changes in law enforcement practices, crime rates, or population density over time.
- **Improve Analytical Methods:** Use advanced statistical modeling or machine learning to detect more complex patterns.

WHY THIS MATTERS:

Understanding patterns in officer fatalities helps law enforcement identify higher-risk times, causes, and conditions, enabling better safety strategies, resource allocation, and training to protect officers on duty.

THANK YOU